

air and very soon returns to the female to mate again. A cracking sound is made by the male when he approaches the female. The sound produced is very feeble and is audible to the human ear at a distance of about one foot only. The female does not chase the male for copulation. It has been observed that the male keeps on riding over the female for hours if the female comes to the water surface quite often. At intervals the frequency of mating is once for every minute and is continued for many days even without any food.

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18. MIGRATIONAL FLIGHTS OF THE COMMON INDIAN CROW BUTTERFLY [*EUPLOEA CORE* (CRAMER)]

In this note I record two migrational flights of the Common Indian Crow butterfly [*Euploea core* (Cramer)] through Bombay, one in a northerly direction seen on 20 June 1960, the second in a southerly direction seen on 23 July 1960.

Since January 1960 I am observing the movements of certain species of butterflies, including *E. core*, in my garden on Pali Hill. I watch from a window on the first floor. Observations are confined to the patch of garden directly in front of the window, measuring roughly 50 ft. by 55 ft. (c. 15 by 16 m.). On the north the area under observation is cut off from the adjoining compound by a dense line of mango trees, a 4 ft. (c. 1 m.) high rubble wall, and low bushes. On the west runs a municipal road, about four feet (c. 1 m.) below the level of the garden. Further west, across the road, there slopes down for about 60 yards (c. 55 m.) a piece of waste land surrounded by mango trees with a few mango trees scattered over it, largely stripped of their leaves and smaller branches by foraging goat-herds and fuel-hunters. On the south the garden extends about 70 ft. (c. 21 m.) more and is separated from the garden next door by a brick wall and a line of trees of various kinds. On the east of the observation area is my house, which extends about 30 ft. (c. 9 m.) further south. Observation is done in watches of 15-minute duration scattered throughout the day.

From the beginning of March, the population of *E. core* was low. In fact, in April I saw only three *E. core* in 97 watches and in May none at all in 73 watches. In 25 watches from the 1st to the 19th June, I saw only one butterfly at all resembling *E. core* but could not identify it with certainty. The first sign of a change came in the morning of 20 June when I noticed one *E. core* flying slowly round in the garden settling on the flowers. Then in my 11.45 to 12.00 watch I observed two *E. core* both flying north, at a height of about 20 ft. (c. 6 m.) above the ground. This was followed by 19 *E. core* in the 12.05-12.20 watch, all flying north at heights varying from 15 to 30 ft. (c. 5 to 9 m.) above the ground. From my post of observation I could see a similar flight taking place over the waste land beyond the road. The butterflies flew steadily and slowly forward at about 6 to 7 miles (c. 10 to 11 km.) per hour. They seemed to take no interest in their surroundings or in each other, except for three over my garden which flew round and round each other for a little while at the same time moving forward slowly to the north. At 13.00 hours, after lunch, I went into the garden. There was no flight in progress and only one *E. core* was to be seen flying slowly from flower to flower in the garden. I went to the waste land across the road and to a more open piece of land further down, but observed no *E. core* in either place. In my next watch, from 13.40 to 13.55 hours, there were 4 *E. core*, 3 flying high and steadily north like those previously observed and one flying low and moving slowly about in the garden.

At the time of these observations there was a slight breeze blowing from the west. The temperature in the shade was about 30.5° C. Rain-clouds covered the sky; the sun showed through in the first watch but was obscured throughout the other two watches. There was no rain.

On the 21st and on subsequent days I continued my watch in the garden and kept a look-out for *E. core* while moving about in Bombay. I saw a few *E. core* flitting about at a low height; there was nothing resembling a migratory flight. This position continued till the 23rd July, when there was a sudden increase in numbers. The main flight this time was from north to south, but it was not as purposeful and uniform as on the previous occasion; also, the butterflies flew more slowly, about 4 to 5 miles (c. 6 to 8 km.) an hour, and after coming over the line of mango trees along the northern boundary of my garden they came down lower than on the 21st June, some of them to about 10 ft. (c. 3 m.) height. My

observations on this day can most conveniently be given in tabular form (Table I).

TABLE I

Time of observation	No. seen and direction of flight							Sun	
								showing	obscured
	S	N	SE	SW	W	E	F	min.	min.
11.40-11.55	13	—	2	—	—	—	2	6	9
12.15-12.30	3	2	—	—	1	1	3	0	15
13.45-14.00	—	1	—	1	—	—	3	15	0
14.20-14.35	3	—	—	—	—	—	2	15	0
Total ..	19	3	2	1	1	1	10	36	24

Note: In the column headed F are shown butterflies which flitted about in the garden.

It will be seen that of the butterflies observed 10 flitted about without flying in any definite direction. Of the rest 19 flew south, 3 north, 2 south-east, 1 south-west, 1 west, and 1 east. I did not notice any flight over the waste land across the road on the west. Between 12.30 and 13.45 hours I visited the open land to the east of my house; there was no flight in progress and only 2 *E. core* were to be seen, flitting about from plant to plant.

The 23rd July was a cloudy day, with no rain, still during the first three watches and a westerly breeze in the fourth watch. The sun was obscured for the greater part of the first watch and the whole of the second watch, and shone throughout the third and fourth watches. The temperature in the shade was about 32.5° C. during these four watches.

On the 24th July, 1 *E. core* was flitting about in the garden at 7.33 a.m. and in six watches later in the day only 2 *E. core* were seen, both flitting about in the garden. Heavy rain interrupted watching from the 25th to the 27th. In the rest of July and in August, the numbers of *E. core* seen were low. In September numbers increased. Table II summarises the changes in population from January to September.

It will be seen that between the two migrations observed by me, and immediately before and after them, the population of *E. core*

TABLE II

	Jan.	Feb.	Mar.	Apr.	May	June			July			Aug.	Sept.
						1-19th	20th	21-30th	1-22nd	23rd	24-31st.		
No. seen	4	53	10	3	0	0	25	3	4	37	6	4	33
No. of watches	61	124	114	97	73	25	3	20	22	4	21	56	48

in my area of observation was small and was not sensibly increased, and in my movements in the city of Bombay I saw very few *E. core*. So it seems likely that Bombay merely lies on the line of migration, outward and return.

Looking through old issues of the Society's journal I find that the northward migration of *E. core* has been observed several times. Aitken (1897, 1901) saw it in at least eleven separate years and reported two specific instances. The earlier report, sent from Ratnagiri, relates to a migration which began on 7 June 1897, but it is not clear at what place the migration was witnessed. The second migration was observed by him from the Esplanade in Bombay on 22 July 1900. The usual date for the northward migration is in the beginning of June according to him, but in 1900 the migration occurred later under peculiar weather conditions. His experience was that the migration continues through one day and sometimes goes on for a second day. The northward migration seen by Miss A. Ghose in Bombay on 13 June 1937 is described as having lasted for only two hours, but must have been on a vast scale as her estimate of the insects that passed through in that time was 30,000 (Williams, 1938, appendix). Of the return journey I can find only one previous report (Aitken, 1898). It was observed over Bombay in July 1898, first noticed on the 26th at 4 p.m., resumed in the early morning on the 27th, and continued till 'the afternoon at least'. The migrations seen by me were on a much smaller scale than those formerly reported, both as to duration and as to the number of insects seen. But they pose the same questions as were put by Aitken long ago: where do the butterflies come from? where do they go? Do the same insects perform the return journey or the immediately following generation as Aitken guessed? why do they migrate? and so on.

Davidson & Aitken (1890) report that in June 1889 in Karwar *E. core* was seen in great numbers which 'almost amounted to a plague', it disappeared in July, and was found again from August onwards. Apart from Aitken's report from Ratnagiri, I have ascertained from some residents of Ratnagiri that the phenomenon of migration is well known in that district. These facts suggest the possibility that Kanara and its neighbourhood are the starting place of the outward migration and the destination of the return migration, and that the route lies along or near the western sea-coast of India. Observations in this area may be fruitful of results.

Aitken (1897) mentions that the villagers connect the northern migration with the approach of the monsoon. In this connection his observation of July 1898, published under the heading 'Butterflies as weather prophets', is interesting. The weather conditions in that year were very gloomy. There was no storm in May, not even distant thunder and lightning. Apart from heavy but irregular rain for about a week, there was very little rain in June. After squally weather on the 12th June and for a few days thereafter the weather set fine and, to the despair of everybody, there appeared to be no prospect of more rain. In these circumstances, when Aitken on seeing the migration on the 22nd July told a friend: 'It is all right—the monsoon is coming in three days', he was ridiculed. But his prophecy came true. On the very next evening there was a heavy shower of rain, there were thunderstorms on the next four evenings, and the monsoon 'broke regularly' on the 28th and continued satisfactorily thereafter. Aitken's conjecture is that the butterflies fly north to escape 'the heavy rain with which the monsoon opens on the southern coast' (Aitken, 1898). Examination of the figures of rainfall in 1897 and 1937 as recorded at the Colaba observatory gives the following results. In 1897, when the migration was observed on the 7th June, the rain started on the 6th and continued steadily to the end of the month with only four days on which there was no rain. In 1937, when the migration occurred on the 13th June, rain started on the 12th June and continued to the end of the month without a break of a single day. Apparently, therefore, there is some connection between the northward migration and the onset of the monsoon. But in 1960, ignoring a few scattered showers in May and the first light rainfall in June, the monsoon began about the 13th June, that is to say about a week before the northward migration. It does not necessarily follow that the belief of the villagers is mistaken, for Bombay is merely on the route of the migration; to attempt an answer

to the question we want to know the weather conditions at the start and at the turn of the migration.

The migration appears to be comparatively limited in its extent, and regular in its occurrence. The metallic gold (sometimes silver) chrysalis of the butterfly, the distinctive marking and shape of its wings, and its leisurely flight make it easy to identify and to observe. It therefore provides an excellent opportunity for probing into the motive causes of insect migration, a problem that is still imperfectly understood. The first requisite is to ascertain the starting and turning points of the seasonal movements, and the routes followed on the outward and the return journey, together with relevant details about dates and local weather conditions. Every scrap of information will help; observers willing to take part in collecting material should address their reports to the Society. Details of the points on which information is desired are set out in the Editorial Note appended to Miscellaneous Note No. 16 at page 430 of the Society's *Journal* Volume 57, No. 2.

To assist those who may desire to help in collecting material it will be useful to complete the analysis of the reports which I have found in the literature consulted.

October appears to be a month in which *E. core* may be expected to be on the move. Prall (1898) reports that on 21 October 1897 he saw a procession of *E. core* 'passing down the harbour' (? going south) at Mody Bunder in Bombay. 'Many hundreds' must have passed in the hour during which he was watching. Andrewes (1909) reports that on 18 October 1908 in Ouchterlony Valley in the Nilgiris he saw *E. core* 'by thousands' floating high over the treetops of the dense forest, all without exception going west. This went on for the four hours that he was there. Three days later, on the 21st, hardly an *Euploea* was to be seen. Wall (1921) on 28 October 1921 witnessed an eastward flight at sea during a voyage from Karachi to Bombay. The flight went on all day and was particularly thick opposite Madiapur on the Kathiawar coast, about 5 to 6 miles (c. 8 to 9 km.) from land. Several species were seen, and among those identified was one '*Euploea*, probably *core*'. As the nearest land to the west is some hundreds of miles distant he conjectured that the butterflies were 'blown out to sea by a strong current and driven back by a reverse current'.

Other observations are a flight to the south-east on 28 March 1909 witnessed by J. Evershed at Kodaikanal in south India

(Williams, 1938, at p. 445), and one to the east in July 1922 witnessed by Tulloch at Deolali (Williams, 1938, at p. 449). My observations showed rises in February and September, but no mass movement.

49, PALI HILL,

BANDRA, BOMBAY 50,

D. E. REUBEN

October 29, 1960.

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19. *PLUSIA (PHYTOMETRA) NI* HB. (NOCTUIDAE) AS A PEST OF CABBAGE, *BRASSICA OLERACEA*, IN SOUTH INDIA

For the past few years a green semilooper, *Plusia ni* Hb., has been found to inflict serious damage on the crop of cabbage (*Brassica oleracea*) in Madurai district. Since the insect has been noted for the first time in south India as a serious pest on cabbage, a crop which is grown on a commercial scale on the hills and in the plains, a short account of it is given in this paper.

DISTRIBUTION. Hampson (1894) has given San Domingo, Europe, St. Vincent (Cape Verde Is.), Aden, Japan, China, and north-west India as its distribution. Fletcher has stated that it occurs throughout India, but the records of its occurrence extend only to Pusa, Lahore, Surat, Kumbharia (Bombay), United Provinces, Gujarat (Fletcher, 1921), and Dehra Dun (Gardner, 1947).

It is of interest to note that Fletcher (1921) has recorded a few species of the genus *Plusia* (*Phytometra*) as occurring on cabbage in N. India; they are *Plusia ni* Hb. in Surat and Kumbharia (Bombay), *P. chalcytes* Fb. in Kumbharia (Bombay), *P. orichalcea* Fb. in Poona, Nagpur, Pusa, etc., and *P. signata* Fb. in Bihar, but he is doubtful about the correct identification of the last named species.

FOOD PLANTS. Larvae of *Plusia ni* Hb. were noted on cauliflower in Pusa and Lahore, on cabbage in Surat and Kumbharia